

## SEQUENCE LISTING

&lt;110&gt; BASF Aktiengesellschaft

&lt;120&gt; GMP synthetase from plants

&lt;130&gt; DE 19947490.7

&lt;140&gt; 0050-50777

&lt;141&gt; 1999-10-01

&lt;160&gt; 4

&lt;170&gt; PatentIn Vers. 2.0

&lt;210&gt; 1

&lt;211&gt; 1973

&lt;212&gt; DNA

&lt;213&gt; Nicotiana tabacum

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (65)..(1678)

&lt;400&gt; 1

gaattcggca cgagattttt ctctatcttt cttcctccca cccaccaccc accctccct 60

tagca atg gaa cct caa aca cag gcg aag aaa tca aac ctc gta cta atc 109  
Met Glu Pro Gln Thr Gln Ala Lys Lys Ser Asn Leu Val Leu Ile

1 5 10 15

ctt gac tac ggt tct cag tac act cac cta atc acc cgc cga atc cga 157  
Leu Asp Tyr Gly Ser Gln Tyr Thr His Leu Ile Thr Arg Arg Ile Arg  
20 25 30atc cta tca att ttc tca ctc acc att aac ggc acc tct tcg tta gac 205  
Ser Leu Ser Ile Phe Ser Leu Thr Ile Asn Gly Thr Ser Ser Leu Asp  
35 40 45tcc ata aaa gaa ctc gac cca cgt gtc att atc ctc tcg ggt gga ccc 253  
Ser Ile Lys Glu Leu Asp Pro Arg Val Ile Ile Leu Ser Gly Gly Pro  
50 55 60cac agc gtc cac gct gac ggc gca ccg tgt ttc cca cct ggg ttc atc 301  
His Ser Val His Ala Asp Gly Ala Pro Cys Phe Pro Pro Gly Phe Ile  
65 70 75

gaa tac gtc gag tca cgt ggg att cac gtg ttg ggt ata tgt tat ggg 349

Glu	Tyr	Val	Glu	Ser	Arg	Gly	Ile	His	Val	Leu	Gly	Ile	Cys	Tyr	Gly
80			85				90				95				
ctg cag ttg att gtt cag aaa ctt ggc ggg gtt gtg aaa att gga gag 397															
Leu	Gln	Leu	Ile	Val	Gln	Lys	Leu	Gly	Gly	Val	Val	Lys	Ile	Gly	Glu
			100				105				110				
aaa cat gag tat ggg aga atg gaa att gag gtt gga aag aat gtt gtt 445															
Lys	His	Glu	Tyr	Gly	Arg	Met	Glu	Ile	Glu	Val	Gly	Lys	Asn	Val	Val
			115				120				125				
ggg ggg ttg ttt ggg aat acg gaa att ggt gat aaa cag gtg gtt tgg 493															
Gly	Gly	Leu	Phe	Gly	Asn	Thr	Glu	Ile	Gly	Asp	Lys	Gln	Val	Val	Trp
			130				135				140				
atg agc cac ggt gat gag gct gtg aaa ttg ccg gaa ggg ttt gag gtt 541															
Met	Ser	His	Gly	Asp	Glu	Ala	Val	Lys	Leu	Pro	Glu	Gly	Phe	Glu	Val
			145			150				155					
gtg gcg agg agt agt cag ggt gct gtt gct att gag aat cgg gaa 589															
Val	Ala	Arg	Ser	Ser	Gln	Gly	Ala	Val	Ala	Ala	Ile	Glu	Asn	Arg	Glu
			160			165				170			175		
ccg agg ttt tat ggg ctg cag tat cat ccc gag gta acg cac tcg act 637															
Arg	Arg	Phe	Tyr	Gly	Leu	Gln	Tyr	His	Pro	Glu	Val	Thr	His	Ser	Thr
			180			185				190					
gaa ggg atg aga aca tta aga cac ttt ctg ttt gat gta tgt ggc gtt 685															
Glu	Gly	Met	Arg	Thr	Leu	Arg	His	Phe	Leu	Phe	Asp	Val	Cys	Gly	Val
			195			200				205					
aca gct ggc tgg aag atg gaa gat gtt ctg gag gaa gaa ata aaa gtt 733															
Thr	Ala	Gly	Trp	Lys	Met	Glu	Asp	Val	Leu	Glu	Glu	Ile	Lys	Val	
			210			215				220					
atc aaa ggt atg gtt gga cct gaa gat cac gtg att tgt gct tta tct 781															
Ile	Lys	Gly	Met	Val	Gly	Pro	Glu	Asp	His	Val	Ile	Cys	Ala	Leu	Ser
			225			230				235					
ggg ggt gtt gat tcc aca gtt gca gct aaa ttg gta cac aag gct atc 829															
Gly	Gly	Val	Asp	Ser	Thr	Val	Ala	Ala	Lys	Leu	Val	His	Lys	Ala	Ile
			240			245				250			255		
ggg gac agg ctt cac tgt gtt ttt gat aat ggt cta tta agg tat 877															
Gly	Asp	Arg	Leu	His	Cys	Val	Phe	Val	Asp	Asn	Gly	Leu	Leu	Arg	Tyr
			260			265				270					
aag gag aga gaa agg gtg atg gaa ctc ttt gag aag cgc ctt cat ttg 925															

Lys Glu Arg Glu Arg Val Met Glu Leu Phe Glu Lys Arg L u His Leu  
275 280 285

cct gtt acc tgt gtc gat gct aca gaa gaa ttt ctc agc aaa cta aaa 973  
Pro Val Thr Cys Val Asp Ala Thr Glu Glu Phe Leu Ser Lys Leu Lys  
290 295 300

ggc gta aca gaa cct gaa atg aag agg aaa ata att ggg aag gag ttc 1021  
Gly Val Thr Glu Pro Glu Met Lys Arg Lys Ile Ile Gly Lys Glu Phe  
305 310 315

atc aac ata ttt gat ctt ttt gcc cat gat gtg gag gaa aaa gta ggg 1069  
Ile Asn Ile Phe Asp Leu Phe Ala His Asp Val Glu Glu Lys Val Gly  
320 325 330 335

aaa aaa cct agt tac cta gtc caa gga acc ttg tat cct gat gta ata 1117  
Lys Lys Pro Ser Tyr Leu Val Gln Gly Thr Leu Tyr Pro Asp Val Ile  
340 345 350

bag tct tgt cct cca cct gga agt gga aga aca cat tct cat aca atc 1165  
Glu Ser Cys Pro Pro Pro Gly Ser Gly Arg Thr His Ser His Thr Ile  
355 360 365

aag agc cat cat aat gtt gga ggt ctt cca aag gac atg aag ctg aag 1213  
Lys Ser His His Asn Val Gly Gly Leu Pro Lys Asp Met Lys Leu Lys  
370 375 380

ctc atc gag cca ctg aaa ctt cta ttc aag gat gag gtt cgt gaa ttg 1261  
Leu Ile Glu Pro Leu Lys Leu Leu Phe Lys Asp Glu Val Arg Glu Leu  
385 390 395

gga aag att ttg gat ata tct gag gac ttt ctt aaa cgc cac ccg ttc 1309  
 Gly Lys Ile Leu Asp Ile Ser Glu Asp Phe Leu Lys Arg His Pro Phe  
 400 405 410 415

cct ggg ccc gga ctc gct gtg cga att cca ggt gat gtc aca gca ggg 1357  
 Pro Gly Pro Gly Leu Ala Val Arg Ile Pro Gly Asp Val Thr Ala Gly  
 420 425 430

aat tcc ttg gat att ctt cgt cag gtt gat gaa atc ttc att caa tca 1405  
Asn Ser Leu Asp Ile Leu Arg Gln Val Asp Glu Ile Phe Ile Gln Ser  
435 440 445

atc aga gat gct aaa atc tat gat gaa ata tgg caa gct ttt gct gtc 1453  
 Ile Arg Asp Ala Lys Ile Tyr Asp Glu Ile Trp Gln Ala Phe Ala Val  
 450 455 460

ttc tta cca gtg aaa act gtt gga gta caa gga gac caa aga acc cat 1501

Phe Leu Pro Val Lys Thr Val Gly Val Gln Gly Asp Gln Arg Thr His  
 465 470 475

tcc cac gct gtt gca ctt aga gca gtc aca agt caa gat gga atg act 1549  
 Ser His Ala Val Ala Leu Arg Ala Val Thr Ser Gln Asp Gly Met Thr  
 480 485 490 495

gca gac tgg tac tac ttt gat ttc aag ttc ctt gac gac gta tca aga 1597  
 Ala Asp Trp Tyr Tyr Phe Asp Phe Lys Phe Leu Asp Asp Val Ser Arg  
 500 505 510

aag atc tgc aat agt gtt cgt ggt gta aat cga gtt ctg ctg gat att 1645  
 Lys Ile Cys Asn Ser Val Arg Gly Val Asn Arg Val Leu Leu Asp Ile  
 515 520 525

aca tca aag cct cca tca aca atc gaa tgg gaa taatttggta taaaatgc 1698  
 Thr Ser Lys Pro Pro Ser Thr Ile Glu Trp Glu  
 530 535

atatttgggt gaccaaagta ggattttttt gtgtttttt gtgcataaca aaaaggaaaga 1758

aatcataat agaaaatttag gtcctttgt tatgtggtag aactggttct tggtaatta 1818

gtgcaatgc tctcaacaat tttgtatgtt tatgggtatg atgataccaa attttactca 1878

atcttggta gtacatttt cttatccaag tatagttaaca tgtggccagg catcaaaagc 1938

tattccact caaaaaaaaaaaaaaaaac tcgag 1973

<210> 2

<211> 538

<212> PRT

<213> Nicotiana tabacum

<400> 2

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Asp Tyr Gly Ser Gln Tyr Thr His Leu Ile Thr Arg Arg Ile Arg Ser  
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Leu Ser Ile Phe Ser Leu Thr Ile Asn Gly Thr Ser Ser Leu Asp Ser  
 35 40 45

Ile Lys Glu Leu Asp Pro Arg Val Ile Ile Leu Ser Gly Gly Pro His  
 50 55 60

Ser Val His Ala Asp Gly Ala Pro Cys Phe Pro Pro Gly Phe Ile Glu  
 65 70 75 80

Tyr Val Glu Ser Arg Gly Ile His Val Leu Gly Ile Cys Tyr Gly Leu  
 85 90 95

Gln Leu Ile Val Gln Lys Leu Gly Gly Val Val Lys Ile Gly Glu Lys  
 100 105 110

His Glu Tyr Gly Arg Met Glu Ile Glu Val Gly Lys Asn Val Val Gly  
 115 120 125

Gly Leu Phe Gly Asn Thr Glu Ile Gly Asp Lys Gln Val Val Trp Met  
 130 135 140

Ser His Gly Asp Glu Ala Val Lys Leu Pro Glu Gly Phe Glu Val Val  
 145 150 155 160

Ala Arg Ser Ser Gln Gly Ala Val Ala Ala Ile Glu Asn Arg Glu Arg  
 165 170 175

Arg Phe Tyr Gly Leu Gln Tyr His Pro Glu Val Thr His Ser Thr Glu  
 180 185 190

Gly Met Arg Thr Leu Arg His Phe Leu Phe Asp Val Cys Gly Val Thr  
 195 200 205

Ala Gly Trp Lys Met Glu Asp Val Leu Glu Glu Glu Ile Lys Val Ile  
 210 215 220

Lys Gly Met Val Gly Pro Glu Asp His Val Ile Cys Ala Leu Ser Gly  
 225 230 235 240

Gly Val Asp Ser Thr Val Ala Ala Lys Leu Val His Lys Ala Ile Gly  
 245 250 255

Asp Arg Leu His Cys Val Phe Val Asp Asn Gly Leu Leu Arg Tyr Lys  
 260 265 270

Glu Arg Glu Arg Val Met Glu Leu Phe Glu Lys Arg Leu His Leu Pro  
 275 280 285

Val Thr Cys Val Asp Ala Thr Glu Glu Phe Leu Ser Lys Leu Lys Gly  
 290 295 300

Val Thr Glu Pro Glu Met Lys Arg Lys Ile Ile Gly Lys Glu Phe Ile  
 305 310 315 320

Asn Ile Phe Asp Leu Phe Ala His Asp Val Glu Glu Lys Val Gly Lys  
 325 330 335

Lys Pro Ser Tyr Leu Val Gln Gly Thr Leu Tyr Pro Asp Val Ile Glu  
 340 345 350

Ser Cys Pro Pro Pro Gly Ser Gly Arg Thr His Ser His Thr Ile Lys  
 355 360 365

Ser His His Asn Val Gly Gly Leu Pro Lys Asp Met Lys Leu Lys Leu  
 370 375 380

Ile Glu Pro Leu Lys Leu Leu Phe Lys Asp Glu Val Arg Glu Leu Gly  
 385 390 395 400

Lys Ile Leu Asp Ile Ser Glu Asp Phe Leu Lys Arg His Pro Phe Pro  
 405 410 415

Gly Pro Gly Leu Ala Val Arg Ile Pro Gly Asp Val Thr Ala Gly Asn  
 420 425 430

Ser Leu Asp Ile Leu Arg Gln Val Asp Glu Ile Phe Ile Gln Ser Ile  
 435 440 445

Arg Asp Ala Lys Ile Tyr Asp Glu Ile Trp Gln Ala Phe Ala Val Phe  
 450 455 460

Leu Pro Val Lys Thr Val Gly Val Gln Gly Asp Gln Arg Thr His Ser  
 465 470 475 480

His Ala Val Ala Leu Arg Ala Val Thr Ser Gln Asp Gly Met Thr Ala  
 485 490 495

Asp Trp Tyr Tyr Phe Asp Phe Lys Phe Leu Asp Asp Val Ser Arg Lys  
 500 505 510

Ile Cys Asn Ser Val Arg Gly Val Asn Arg Val Leu Leu Asp Ile Thr  
 515 520 525

Ser Lys Pro Pro Ser Thr Ile Glu Trp Glu  
 530 535

<210> 3

<211> 1232

<212> DNA

<213> *Physcomitrella patens*

<220>  
 <221> CDS  
 <222> (3)...(1148)

&lt;400&gt; 3

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gaa aat gtg gat tcc aga atc tac gcc ctc caa tac cat ccc gag gtt 95  
 Glu Asn Val Asp Ser Arg Ile Tyr Ala Leu Gln Tyr His Pro Glu Val  
 20 25 30

acg cac tca gag aaa ggg aca gag act ttg aga cac ttt ttc ctg aat 143  
 Thr His Ser Glu Lys Gly Thr Glu Thr Leu Arg His Phe Phe Leu Asn  
 35 40 45

tc tgc ggc atg aag gct gac tgg cag atg cag aat gtg ttg gag gaa 191  
 Val Cys Gly Met Lys Ala Asp Trp Gln Met Gln Asn Val Leu Glu Glu  
 50 55 60

gag att aaa aag gtc act gcg acc gtc ggc cca gat gat cat gtt att 239  
 Glu Ile Lys Lys Val Thr Ala Thr Val Gly Pro Asp Asp His Val Ile  
 65 70 75

tgt gca ctc tcc ggg ggc gtg gac tca aca gta gca gct act ctg gtg 287  
 Cys Ala Leu Ser Gly Gly Val Asp Ser Thr Val Ala Ala Thr Leu Val  
 80 85 90 95

acg cgt gct att gga gat cgc ctt cat tgt gtg ttt gta gat aat ggc 335  
 His Arg Ala Ile Gly Asp Arg Leu His Cys Val Phe Val Asp Asn Gly  
 100 105 110

ttt tgc aga tac aag gaa aga gaa aga gtg atg gcc aca ttt gtg aaa 383  
 Leu Cys Arg Tyr Lys Glu Arg Glu Arg Val Met Ala Thr Phe Val Lys  
 115 120 125

gac ctt cat ctg cca gtc act tgt gtg gat gcc act gag cag ttt ctc 431  
 Asp Leu His Leu Pro Val Thr Cys Val Asp Ala Thr Glu Gln Phe Leu  
 130 135 140

agc aaa ttg aag ggc gtg gta gat cca gag aga aag agg aag atc atc 479  
 Ser Lys Leu Lys Gly Val Val Asp Pro Glu Arg Lys Arg Lys Ile Ile  
 145 150 155

gga gca gag ttt att gca gtc ttt gat gaa ttt tcg cac aga ttg gag 527  
 Gly Ala Glu Ph Ile Ala Val Ph Asp Glu Phe Ser His Arg Leu Glu  
 160 165 170 175

aga gag att gga aag atg cct gct ttc ctt gtg cag gga aca ctt tat 575  
 Arg Glu Ile Gly Lys Met Pro Ala Phe Leu Val Gln Gly Thr Leu Tyr  
 180 185 190

cca gat gtc att gag tcg tgt cct cct cca ggg agc ggg aag tcg cat 623  
 Pro Asp Val Ile Glu Ser Cys Pro Pro Pro Gly Ser Gly Lys Ser His  
 195 200 205

tcc cac aca atc aaa agt cat cac aac gtc ggt ggc ttg ccc gag aac 671  
 Ser His Thr Ile Lys Ser His His Asn Val Gly Gly Leu Pro Glu Asn  
 210 215 220

atg aaa ttg aag ttg gag cct ctc aag tgg ctc ttc aaa gac gag 719  
 Met Lys Leu Lys Leu Val Glu Pro Leu Lys Trp Leu Phe Lys Asp Glu  
 225 230 235

gta cgc gaa atg ggt gca ttg ttg gat gta cct gtt tcc ttt ttg aag 767  
 Val Arg Glu Met Gly Ala Leu Leu Asp Val Pro Val Ser Phe Leu Lys  
 240 245 250 255

cgc cat cct ttc cct gga cct gga ttg gcc gtt cga att ctt ggg gat 815  
 Arg His Pro Phe Pro Gly Pro Gly Leu Ala Val Arg Ile Leu Gly Asp  
 260 265 270

gta act cag gac ggc gca ctc gac act atc cgc ttg gtt gat gag atc 863  
 Val Thr Gln Asp Gly Ala Leu Asp Thr Ile Arg Leu Val Asp Glu Ile  
 275 280 285

ttt gtg aac agc att cga gag gca ggt ctt tac gat aag atc tgg cag 911  
 Phe Val Asn Ser Ile Arg Glu Ala Gly Leu Tyr Asp Lys Ile Trp Gln  
 290 295 300

gca ttt gct gtt tat ctg cca gta aag act gtt ggc gtt caa ggc gac 959  
 Ala Phe Ala Val Tyr Leu Pro Val Lys Thr Val Gly Val Gln Gly Asp  
 305 310 315

aaa cgg aca cat tca cac gct gtt gct cta cgt gca att aca agt gaa 1007  
 Lys Arg Thr His Ser His Ala Val Ala Leu Arg Ala Ile Thr Ser Glu  
 320 325 330 335

gac gga atg act gct gac tgg ttt cat ttt gat gga aag ttt ctt gcc 1055  
 Asp Gly Met Thr Ala Asp Trp Phe His Phe Asp Gly Lys Phe Leu Ala  
 340 345 350

gag gta tca tct aaa atc tgc aac agc gta agg ggt atc aat agg gtg 1103  
 Glu Val Ser Ser Lys Ile Cys Asn Ser Val Arg Gly Ile Asn Arg Val  
 355 360 365

gta tac gac att acg tct aaa cct cca tca act gtt gag tgg gaa 1148  
 Val Tyr Asp Ile Thr Ser Lys Pro Pro Ser Thr Val Glu Trp Glu  
 370 375 380

tagacgtcag taatgtatTT tggaagtact gttggttatg acgattcact gcaatactta 1208

acaaaactatt ttatacttca aaaa 1232

<210> 4  
 <211> 382  
 <212> PRT  
 <213> Physcomitrella patens

<400> 4

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 20 25 30

His Ser Glu Lys Gly Thr Glu Thr Leu Arg His Phe Phe Leu Asn Val  
 35 40 45

Cys Gly Met Lys Ala Asp Trp Gln Met Gln Asn Val Leu Glu Glu  
 50 55 60

Ile Lys Lys Val Thr Ala Thr Val Gly Pro Asp Asp His Val Ile Cys  
 65 70 75 80

Ala Leu Ser Gly Gly Val Asp Ser Thr Val Ala Ala Thr Leu Val His  
 85 90 95

Arg Ala Ile Gly Asp Arg Leu His Cys Val Phe Val Asp Asn Gly Leu  
 100 105 110

Cys Arg Tyr Lys Glu Arg Glu Arg Val Met Ala Thr Phe Val Lys Asp  
 115 120 125

Leu His Leu Pro Val Thr Cys Val Asp Ala Thr Glu Gln Phe Leu Ser  
 130 135 140

Lys Leu Lys Gly Val Val Asp Pro Glu Arg Lys Arg Lys Ile Ile Gly  
 145 150 155 160

Ala Glu Phe Ile Ala Val Phe Asp Glu Phe Ser His Arg Leu Glu Arg  
 165 170 175

Glu Ile Gly Lys Met Pro Ala Phe Leu Val Gln Gly Thr Leu Tyr Pro  
 180 185 190

Asp Val Ile Glu Ser Cys Pro Pro Pro Gly Ser Gly Lys Ser His Ser  
 195 200 205

His Thr Ile Lys Ser His His Asn Val Gly Gly Leu Pro Glu Asn Met  
 210 215 220

Lys Leu Lys Leu Val Glu Pro Leu Lys Trp Leu Phe Lys Asp Glu Val  
 225 230 235 240

Arg Glu Met Gly Ala Leu Leu Asp Val Pro Val Ser Phe Leu Lys Arg  
 245 250 255

His Pro Phe Pro Gly Pro Gly Leu Ala Val Arg Ile Leu Gly Asp Val  
 260 265 270

Thr Gln Asp Gly Ala Leu Asp Thr Ile Arg Leu Val Asp Glu Ile Phe  
 275 280 285

Val Asn Ser Ile Arg Glu Ala Gly Leu Tyr Asp Lys Ile Trp Gln Ala  
 290 295 300

Phe Ala Val Tyr Leu Pro Val Lys Thr Val Gly Val Gln Gly Asp Lys  
 305 310 315 320

Arg Thr His Ser His Ala Val Ala Leu Arg Ala Ile Thr Ser Glu Asp  
 325 330 335

Gly Met Thr Ala Asp Trp Phe His Phe Asp Gly Lys Phe Leu Ala Glu  
 340 345 350

Val Ser Ser Lys Ile Cys Asn Ser Val Arg Gly Ile Asn Arg Val Val  
 355 360 365

Tyr Asp Ile Thr Ser Lys Pro Pro Ser Thr Val Glu Trp Glu  
 370 375 380